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TECHNICAL REPORT

71-31-GP

FIELD EVALUATION OF TYPE 1, CLASS E, UNIT LOADS TO DETERMINE CAUSES OF CORROSION ON CANS OF NONPERISHABLE SUBSISTENCE

by

Anderson Miller

September 1970

UNITED STATES ARMY
NATICK LABORATORIES
Natick, Massachusetts 01760

General Equipment & Packaging Laboratory

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FIELD EVALUATION OF TYPE 1, CLASS E, UNIT LOADS TO DETERMINE CAUSES OF CORROSION ON CANS OF NONPERISHABLE SUBSISTENCE

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ANDERSON MILLER
Packaging Division

Project Reference: O&MA

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FOREWORD

The requirement for the protection of metallic items against corrosion has been one of the continuing problems of military supply, and a sizable group of specifications and standards are available to cover the requirements of any particular item.

In this case, the study is concerned with the corrosion of uncoated bright metal cans which are used for the bulk of canned nonperishable subsistence. The study evaluates the performance of ten different load configurations, including those now in use in Southeast Asia in conformance with Military Specification MIL-L-35078, under the conditions of long-term outdoor storage in a Pacific Coast Port Terminal Area. Results will be utilized to make recommendations for changes in unit load design, as appropriate.

The evaluation was accomplished in cooperation with DSA, DPSC, and the Veterinary Detachment of the Naval Supply Center, Oakland, California as technical support and assistance to the DSA procurement agencies in the Technical Service Area of the Production Engineering Program (O&MA).

Acknowledgment is made to Messrs. William T. Curley and Stanley J. Werkowski of these Laboratories for their assistance in the statistical analysis of the data obtained.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF FIGURES (Continued)

LIST OF TABLES

ABSTRACT

Can corrosion problems were being reported by the Defense Supply Agency on standard sheathed, shrouded, and palletized loads of non-perishable subsistence which could not be alleviated by field expedients applied to the loads.

To obtain data on a controlled basis, a test program was initiated to expose to condensation 90 unit loads, consisting of ten groups of nine loads each. The site chosen was the Naval Supply Center at Oakland, California, and tests were initiated with the cooperation of their Veterinary Detachment, Headquarters of the Defense Supply Agency, and Defense Personnel Support Center under the monitorship of U. S. Army Natick Laboratories. Tests included variables in exposure time, sheathing, internal polyethylene shroud, taping, ventilation, and configuration of the assembled load.

INTRODUCTION

For overseas shipment of nonperishable canned subsistence items, Military Specification MIL-L-35078 requires Type 1, Class E, unit loads. These loads consist of palletized case canned items sheathed in V2s solid fiberboard with an inner polyethylene shroud added to provide extra protection for the loads against the high rainfall conditions which exist in Southeast Asia.

In response to reports of can corrosion from condensation in the Oakland, California area, surveys and tests were initiated to determine the extent of damage and conditions conducive to causing the problem and to recommend methods to correct the problem. After preliminary laboratory tests, a large scale exposure test was initiated by NLABS, DSA, and DPSC and conducted at Naval Supply Center, Oakland with the cooperation of their Veterinary Detachment.

Variables in the test included nine different palletization systems, consisting of nine loads each, to be examined periodically for a total time of eight months. Data were taken on the number of cans with varying degrees of corrosion in the different layers with specific emphasis placed on the top layers, which were the most susceptible to corrosion.

PROCEDURE

An outdoor field test was designed and initiated in July, 1969 at the Naval Supply Center at Oakland, California, to provide test data for use in solving the problem of can corrosion which occurs in standard loads described above.

To accomplish the test, various methods of preparing the unit loads were evaluated. The methods used were as follows:

Method 1, Control:

The loads were packed in accordance with Military Specification MIL-L-35078 and consisted of Number 10 cans packed in V2s containers palletized with a 3-mil polyethylene shroud and V2s sheathing and cap.

Method 2, Taped with Polyethylene Shroud:

Same as Method 1, except all containers were taped with one strip of weather-resistant tape extending over the center opening of the container top and bottom.

Method 3, Polyethylene Shroud Removed:

Same as Method 1, except that the polyethylene shroud was removed.

Method 4, Asphalt Barrier:

Same as Method 1, except that the polyethylene shroud was removed and replaced with an asphalt barrier liner (H-1) conforming to Federal Specification PPP-B-1055.

Method 5, Wax Impregnated Sheathing:*

Same as Method 1, except the polyethylene shroud and V2s sheathing were removed and replaced with 350-pound test single-wall corrugated wax-impregnated fiberboard conforming to Federal Specification PPP-B-001163.

Method 6, Totally Inclosed:

Same as Method 1, except that two shrouds were used. One shroud was placed under the bottom of the load and extended up to the top of the load. The second shroud was placed over the top of the load and extended down to the bottom.

Method 7, Partial Shroud:

Same as Method 1, except that the full shroud was removed and replaced with a short shroud which extended only over the top layer of containers.

Method 7A, Ventilated Load:

Same as Method 1, except that the polyethylene shroud was removed and a flat slatted wood frame 48" by 40" by 1-1/2" with a polyethylene sheet stapled to the top was placed under the cap. (See Figure 1.)

Method 8, Taped without Polyethylene Shroud:

Same as Method 2, except that the polyethylene shroud was removed.

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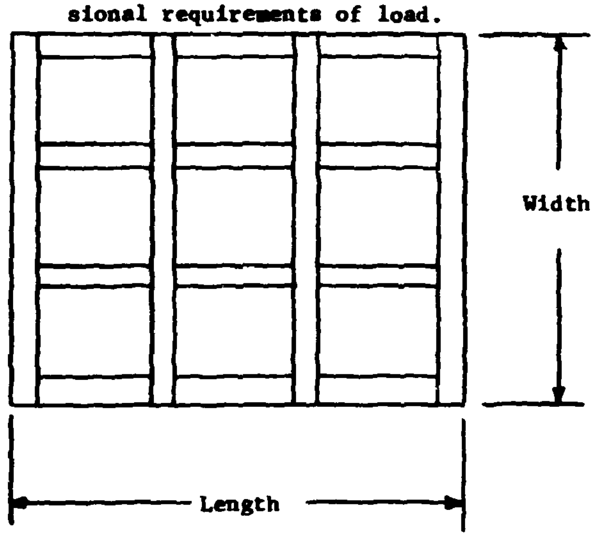
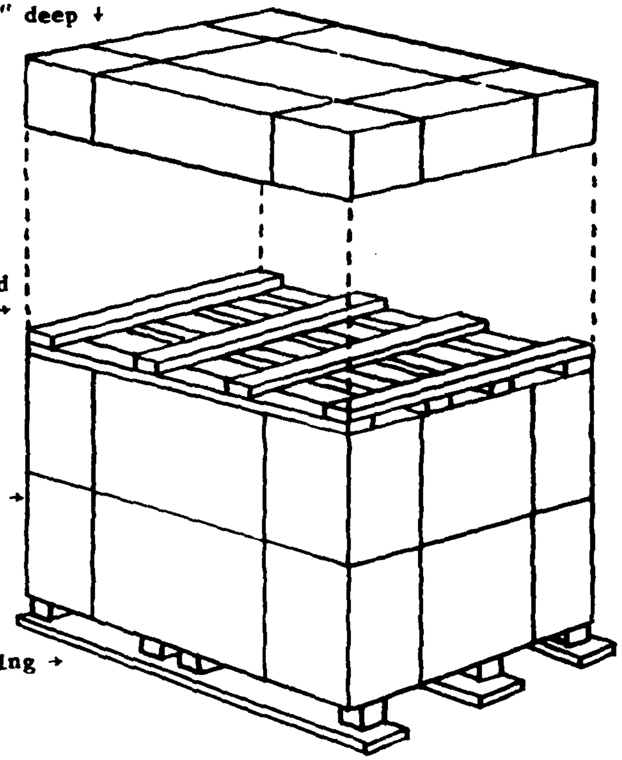
*Grade 350-pound test board was used because 275-pound test, as allowed in Military Specification MIL-L-35078, was not readily available in the small quantity required for the test.



Top View



Schematic View

Figure 1. Slatted frame used for ventilating top layer of load.

Method 9, Negative Pressure:

Same as Method 3, except that the nine loads were stacked together in a three by three pattern adjacent to each other at the test site and covered with a 6-mil black polyethylene tarpaulin. The complete unit was then equipped with a fan which exhausted the air by operating continuously at a static pressure of one to two inches, as measured by water gauge.

A total of 90 unit loads of canned green peas packed in No. 10 size cans were taken from stock which had been stored in a warehouse since receipt at the Oakland Naval Supply Center. Random samplings from approximately five to six loads were opened and the cans examined for damage or rust. The cans in the top layers of these loads revealed various degrees of corrosion from rust, with no pitting to light pitting, rust on top, sides, and bottom of some of the cans. Further examination of some of the layers below the top layer showed that this condition existed throughout these loads. For example, one layer might contain a mixture of both bright, unrusted cans and cans containing light and pitted rust. Since there were no other commodities available that would have less corrosion than the peas, it was decided to perform an initial evaluation on the canned green pea cans using the following rating system and to evaluate the effect of subsequent storage in terms of changes from these initial ratings.

0 - No Rust

1 - Rust, No Pitting

2 - Rust, Light Pitting

3 - Rust, Heavy Pitting

4 - Rust, Heavy Pitting and Rust over Top and Most of the Side Wall

All cans in the top layer were examined and assigned a number which corresponded to the condition of the can. The rating was recorded on the can to be used as a basis for determining the increase in corrosion during exposure to outdoor conditions. To maintain control, consistency, and repeatability using this somewhat subjective rating system, the same individual made all the ratings.

All containers except those scheduled for full tape closure were closed with short strips of tape extending approximately two to three inches down the end face with two to three inches over the top, so that the opening between the outer flaps was not sealed. The containers scheduled for full tape closure in methods numbers 2 and 8 were sealed with one strip of tape on the bottom and one on the top, covering the full lengthwise container openings between the outer flaps and extending approximately three inches down the end face.

The unit loads were then divided into nine groups of nine each and prepared for the field test as described previously. Each group of nine loads represented one of these various methods of packing.

After the loads were prepared, they were moved to the outdoor storage site, and each of the groups of nine loads were divided into subgroups of three each. Each of the subgroups in palletization systems 1 to 8 was spaced approximately two feet apart, with the three loads adjacent to each other. All nine of the loads in the negative pressure system were placed in a three by three pattern adjacent to each other to facilitate the operation of the negative pressure system. (See Figure 2.)

After 30 days, 60 days, and again after 90 days, one subgroup of each of the nine groups was opened and examined for damage to the cans caused by corrosion. Upon completion of the examination for the 30- and 60-day periods, the loads from palletization systems 1 through 8 were returned to the warehouse to be placed back in supply. The remaining loads from the 90-day examination from groups 1, 5, 7, 7A, 8, and the negative pressure group were repacked and returned to the test area to maintain the same test layout and configuration until the test was completed. Figure 2 shows the positioning of the loads at the storage site.

At the 30-day point of the test, the top layer of a subgroup of each variable was examined to determine if any increase in the accumulation of corrosion had occurred on the surface of the cans. Where an increase in corrosion was found, the change in classification number of cans was recorded for each variable. The layers below the top containers were examined and the condition of the cans recorded to establish a basis for comparing the performance of the various methods of packaging in protecting the entire load throughout the test period. It was expected that the lower layers of some of these loads would be affected by adverse weather conditions.

One subgroup of each of these variables was then examined after sixty days and the final subgroups after ninety days. The results of these examinations were compiled, and a comparison was made of the performance of each variable over the 90-day period. The loads which showed promise of offering better protection (plus the control loads) against can corrosion were repacked and returned to the test site to be exposed to prolonged rainfall which was expected to start in the

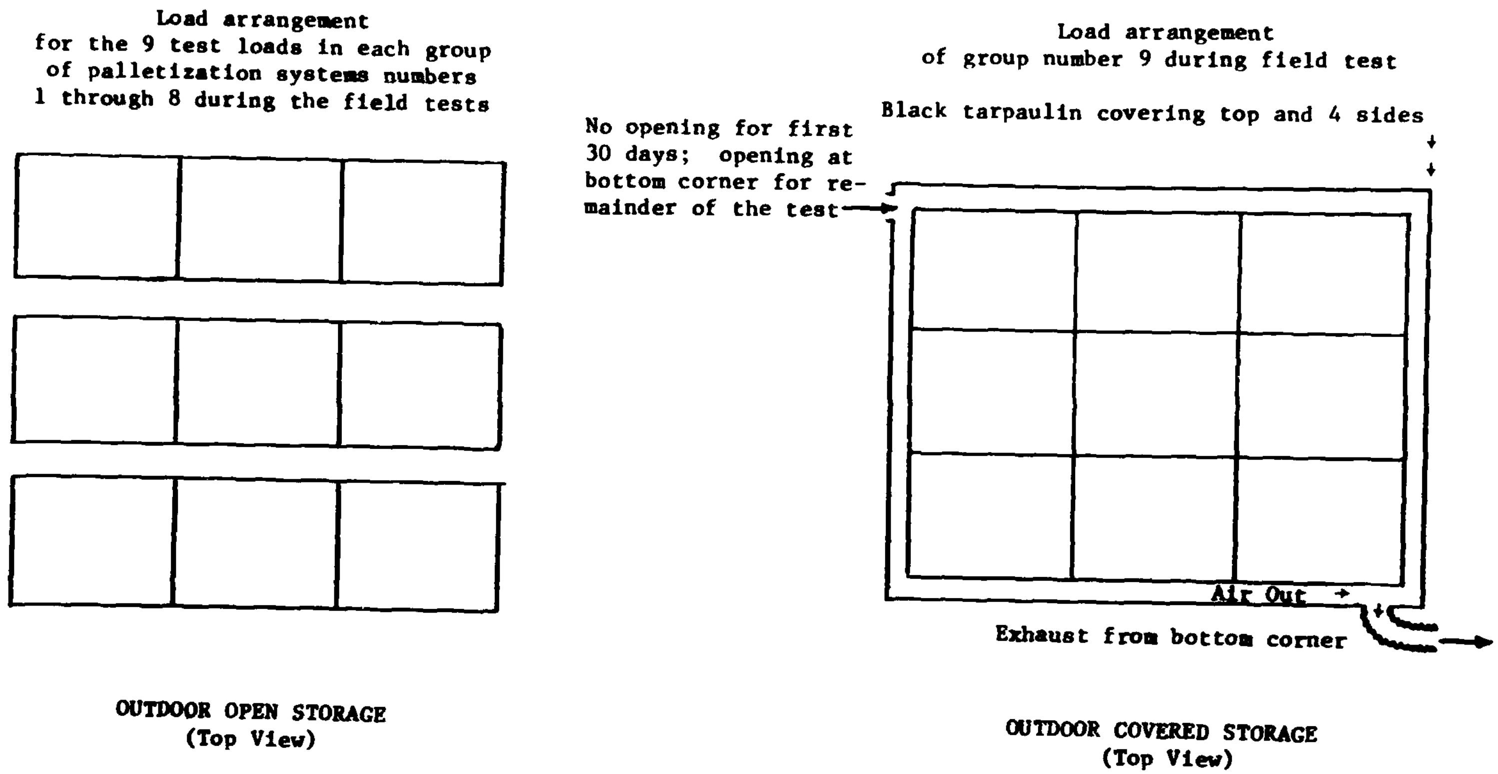


Figure 2. Load arrangements of groups at test site for the outdoor exposure tests at Oakland, California.

Oakland area about the month of December. These loads were as follows:

- Method 1 - Control Loads
- Method 5 - Wax Impregnated Sheathed Loads
- Method 7 - Partially Shrouded Loads
- Method 7A - Ventilated Loads
- Method 8 - Taped Loads without Shroud
- Method 9 - Negative Pressure Loads

Detailed descriptions of the above loads are the same as described previously.

In order to determine which of the above load variables offered the best protection, a statistical analysis was performed on all variables evaluated in this study. The analysis was performed in accordance with paragraph 9.2, Section 2, Analysis of Enumerative and Classificatory Data, of AMC Pamphlet 706-11 entitled "Experimental Statistics". Comparison of the data was based on the Chi-Square at the 95% level of significance. After observation of the data, the performance of the loads after the 90-day period was selected for analysis.

RESULTS

The results of the test after 90 days based on examination of the loads showed that the packaging methods which provided the best protection for the cans was 7A. Methods 5, 7, and 8 were equal and performed better than the remaining methods tested.

The remaining loads tested, except for group 9 which was under Negative Pressure, showed an increase in corrosion. The loads in group 9 remained dry on the top layer. However, the three loads near the opening in the tarpaulin sustained some corrosion in all layers as a result of the fan pulling moisture into the unit. The standard unit loads with shroud performed better than the standard loads without shroud in protecting the entire loads over the 90-day period. The shrouded standard loads had sustained an increase in corrosion only on the top layer, whereas the standard loads without the shrouds had evidence of excessive increased corrosion on the top layer and a slight increase in corrosion in the layers below the top. After

90 days all of the layers of the standard loads without shroud had more cans in number 2 rust classification than any of the other load variables tested.

After consideration of the condition of the loads and the additional five months of exposure to rainfall conditions at the storage site, in conjunction with the test results of the previous exposure cycles, it is considered that the method which provided the best protection for the cans was method 7A. Methods 5, 7, and 8 were equal and performed better than the remaining methods tested.

The control loads continued to show increase in corrosion of the cans of the top layer. Moisture and water droplets were continuing to collect on the inner surface of the top of the polyethylene shroud and on the tops of some of the cans in the top layer. There was no evidence of any water entering the load as a result of the rainfall exposure to which the loads were subjected. The loads in the negative pressure groups sustained an increase in corrosion over the first thirty days, but were dried out and remained free of water droplets throughout the test when provided with ventilation by the opening in one side for air to circulate. There was no significant increase in corrosion in the top layer of any of these loads over the additional five months storage test. In the loads nearest the opening used for ventilation, the cans of the layers below the top layer were beginning to show signs of corrosion. It appears that additional design studies are required before such a system could be put into effect. Statistical analysis of the data substantiated the observed results of the test.

The final results of the findings in this study are shown in Figure 3. Detailed test results of the top layers are shown graphically in Appendix A. Temperature data are tabulated in Appendix B, as well as tabulated test results for all layers of the loads.

DISCUSSION OF RESULTS

Even though the loads with the ventilated tops (Group 7A) performed better than the remaining groups selected for the additional exposure tests, this method of protection would be the most complicated of the four because of the slatted frame required. However, because of their satisfactory performance, all four test designs (7A, 5, 7, and 8) could be considered for further testing in a trial shipment. It should be noted that occasional occurrence of corrosion can be expected with any of these methods because of the uncontrollable variables in packing line operations and adverse temperature and humidity conditions throughout the supply line.

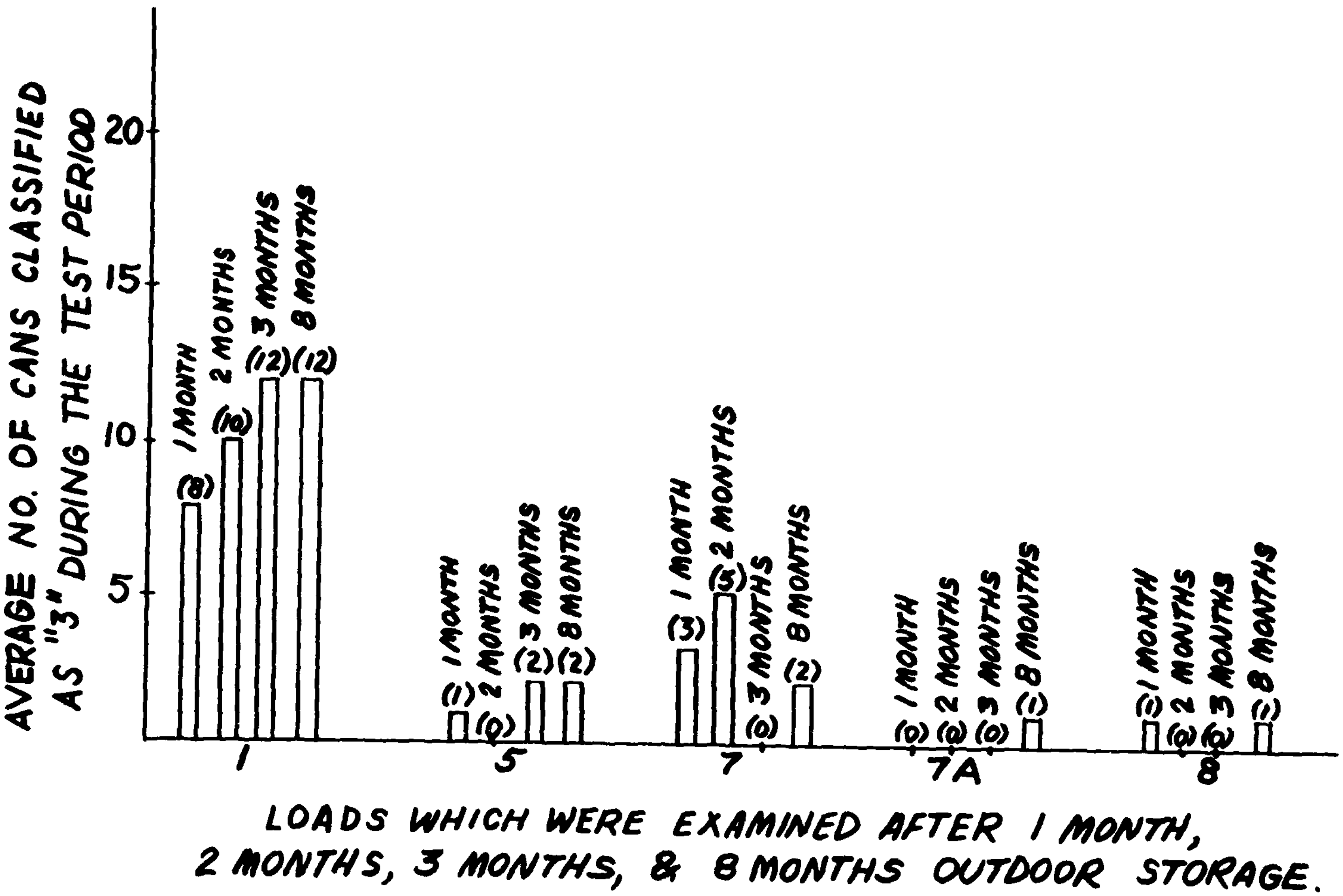


Figure 3. Bar graph showing condition of cans after each examination. (Shown are average number of cans in the top layer of the loads which had sustained corrosion that was classified as "3" after each examination.)

The loads under the negative pressure test apparently had sustained all the damage on the top layer in the first 90 days. These layers were dry when examined after the extended five months period of the test. The layers beneath the top layers of the loads near the opening in the tarpaulin have begun to pick up rust which appeared to have been caused by the fan pulling moisture into the load and causing condensation to settle on the cans. Evidently the moisture which entered the stack came in from the bottom and ascended toward the top, since the bottom layer sustained more corrosion than the upper layers of these particular loads.

The examination of the layers below the top layer of all other variables showed that there was no significant damage caused by corrosion. The cans which were affected in several loads had not sustained corrosion which could be classified above the "2" rating as described previously.

The four methods for which the performance is considered satisfactory are (1) the loads with wax impregnated sheathing, (2) the ventilated V2s sheathed loads, (3) partially shrouded load with shroud over top layer only, and (4) V2s sheathed loads containing taped containers without the polyethylene shroud. These methods are selected based on the performance of all loads over the entire test period.

CONCLUSIONS

Based on the results of the test, it is concluded that

1. The full polyethylene shroud used in the unit loads of canned subsistence does induce condensation under the top of the shroud and on the cans in the top layer of the load. However, removal of the shroud resulted in even greater evidence of corrosion.

2. Any of the four test methods shown in Figure 3 -- (a) wax impregnated fiberboard sheathed loads, (b) partially shrouded V2s sheathed loads, (c) ventilated V2s sheathed loads with slatted frame, or (d) V2s sheathed loads with the taped boxes without polyethylene shroud can be expected to perform satisfactorily under field conditions.

3. Statistically, the loads with the slatted frame for ventilation (Method 7A) provided the best protection of all methods tested. There was no significant difference among the other three satisfactory methods.

Group 7A performed slightly better than 5, 7, and 8, and there is no significant difference among groups 5, 7, and 8.

APPENDIX A

APPENDIX A

Figure 4 Figure 5 Figure 6	Results of the examination of the cans in the top layer of each group after a minimum of 30 days outdoor exposure. The graphs show the average of the number of cans in the three loads of each group which had corrosion that had progressed to the "3" classification, as described previously, after 30, 60, and 90 days, respectively.
Figure 7	Results of the condition of the cans in the top layer of the loads which were selected to continue in the test for additional five months. The graph shows the average number of cans which had progressed to the "3" classification over the extended test period.
Figure 8 Figure 9 Figure 10	Conditions of the cans at the beginning of the test. The graphs show the average number of bright metal cans in the top layer of the group which were free of rust at the beginning of the test.

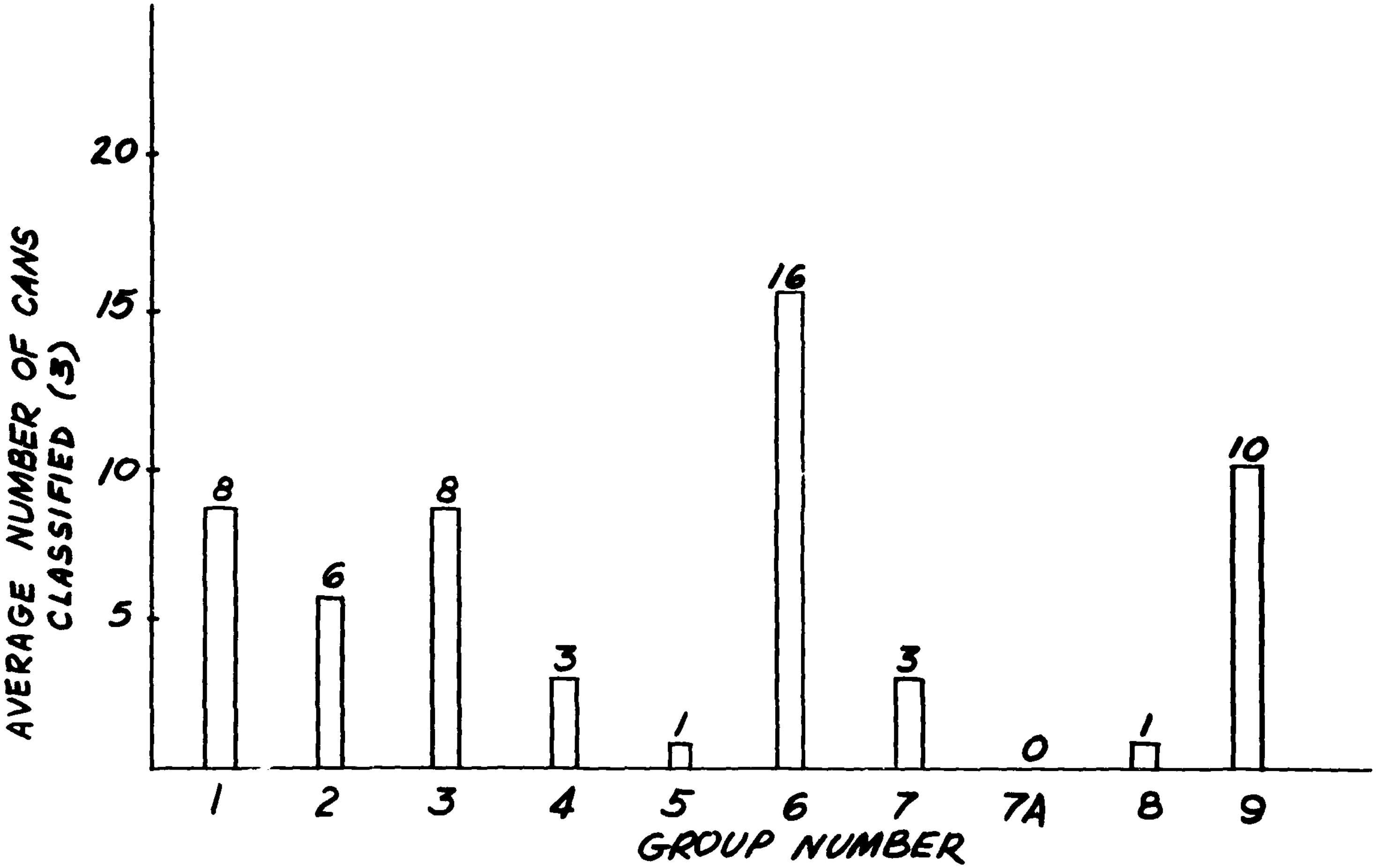


Figure 4. Average number of cans in the top layer of the loads which had sustained corrosion that had progressed to classification "3". (Loads examined after 30 days.)

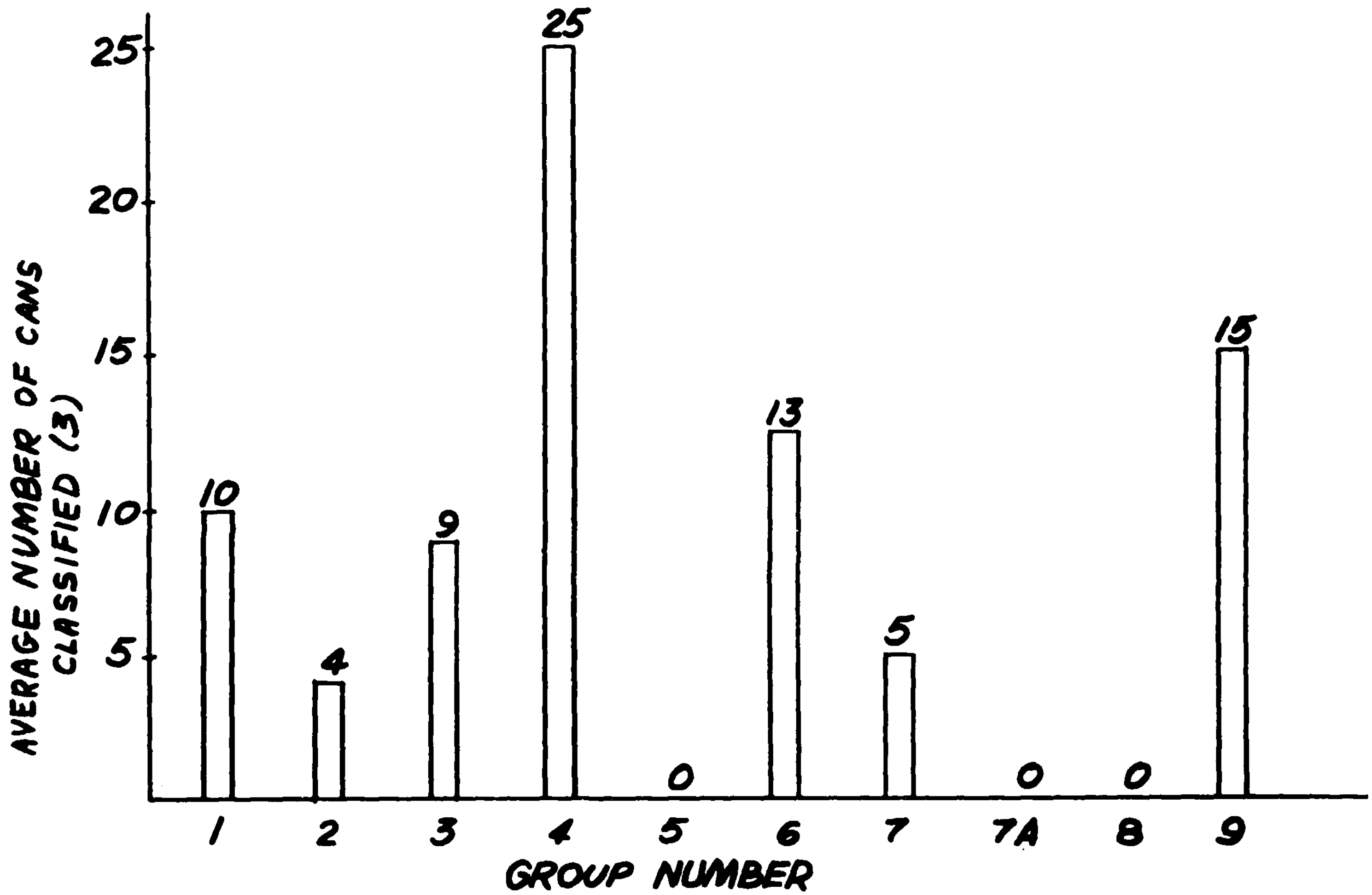


Figure 5. Average number of cans in the top layer of the loads which had sustained corrosion that had progressed to classification "3". (Loads examined after 60 days.)

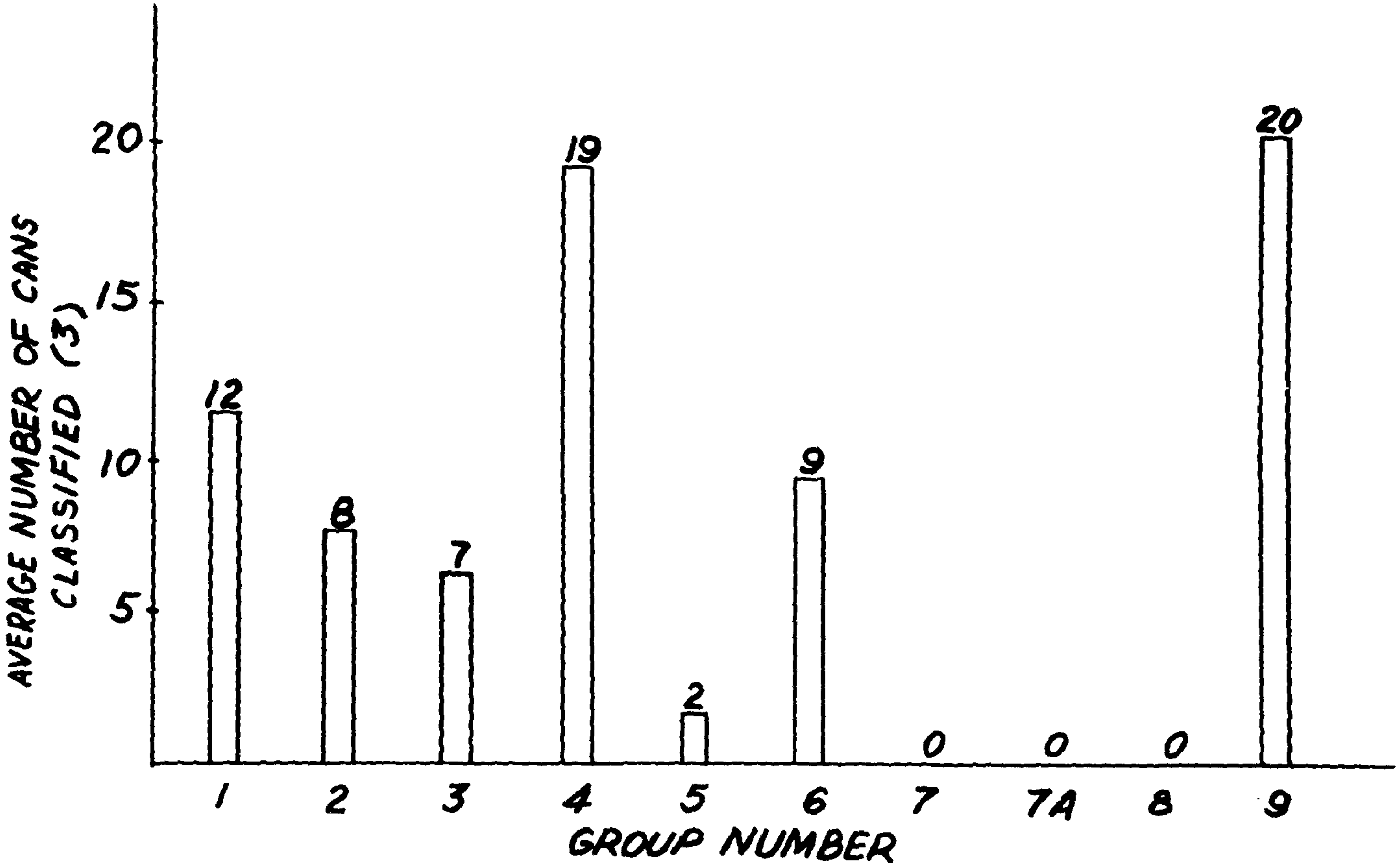


Figure 6. Average number of cans in the top layer of the loads which had sustained corrosion that had progressed to classification "3". (Loads examined after 90 days.)

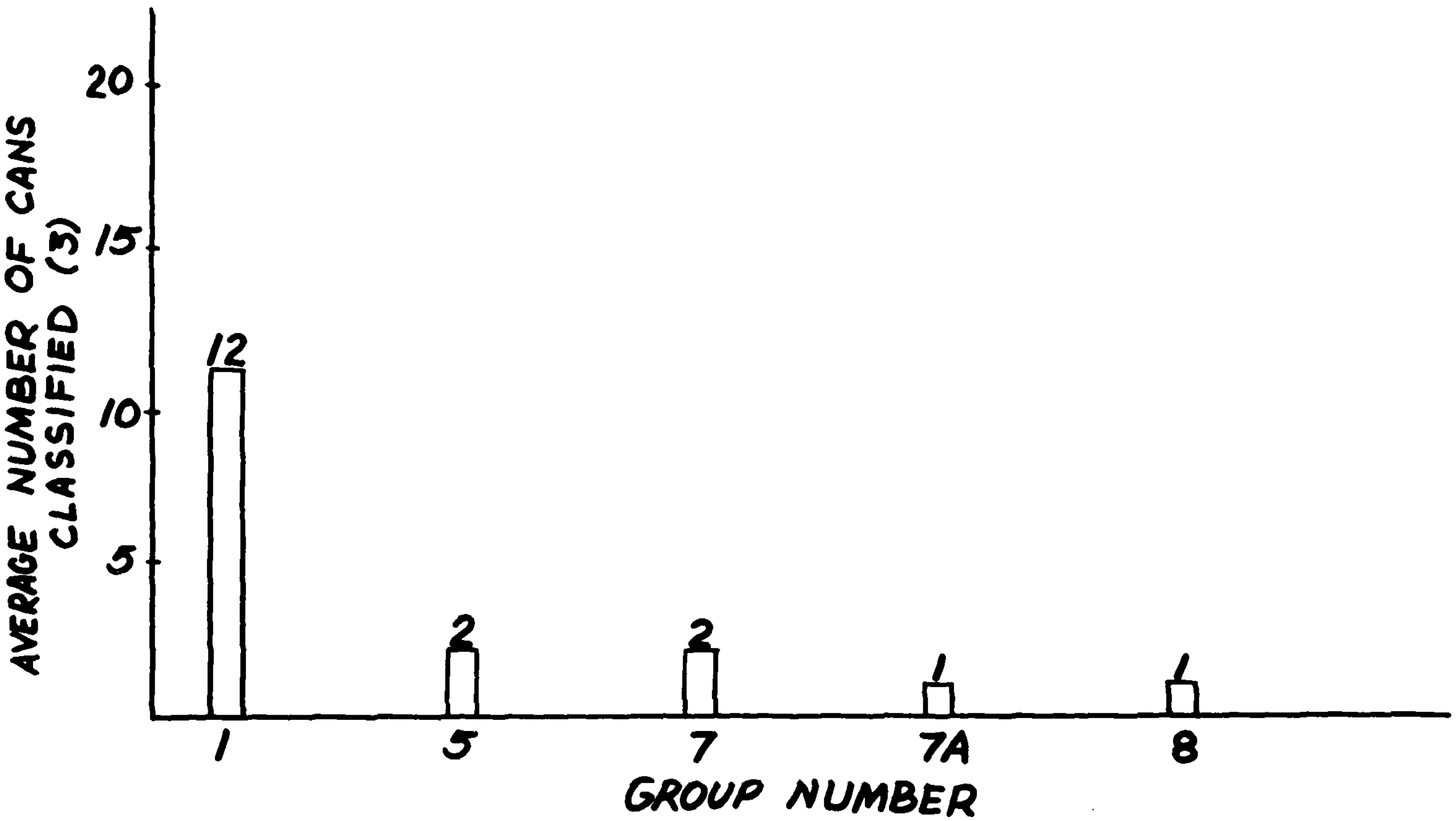


Figure 7. Average number of cans in the top layer of the loads which had sustained corrosion that was classified as "3". (Loads examined after 8 months.)

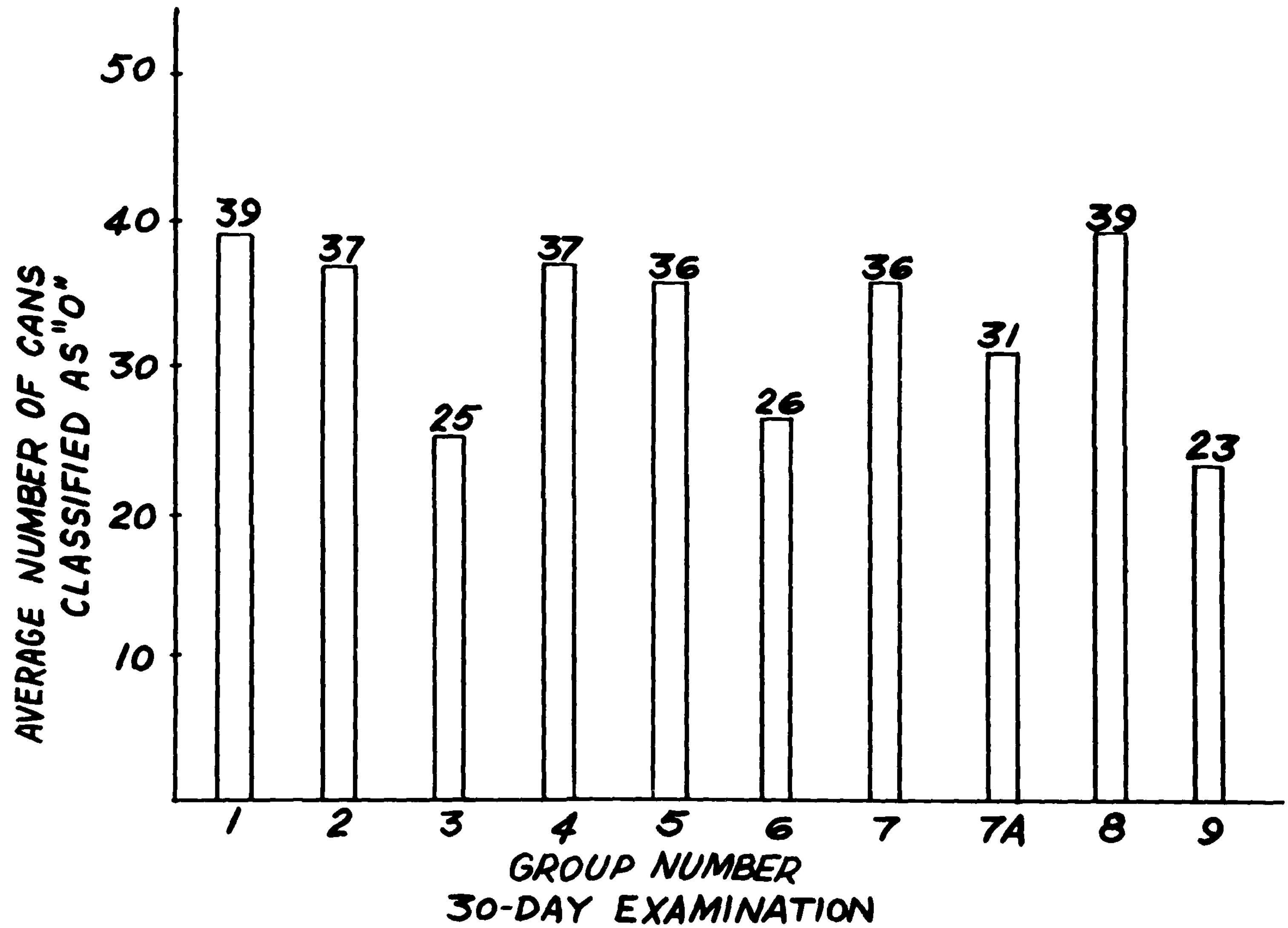


Figure 8. Average number of cans which were classified as "0" at the beginning of test - for the groups examined after 30 days.

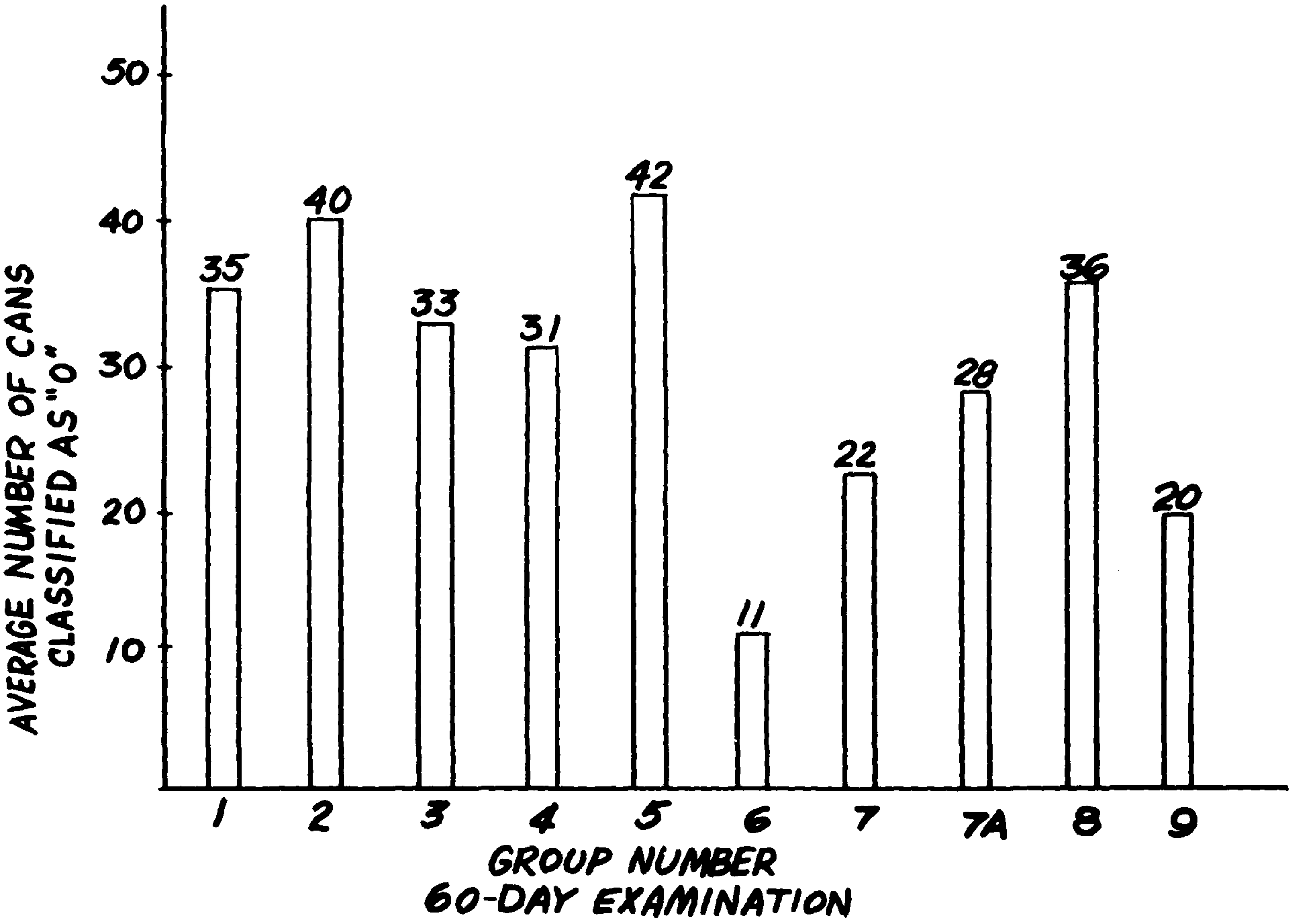


Figure 9. Average number of cans which were classified as "0" at the beginning of test - for the groups examined after 60 days.

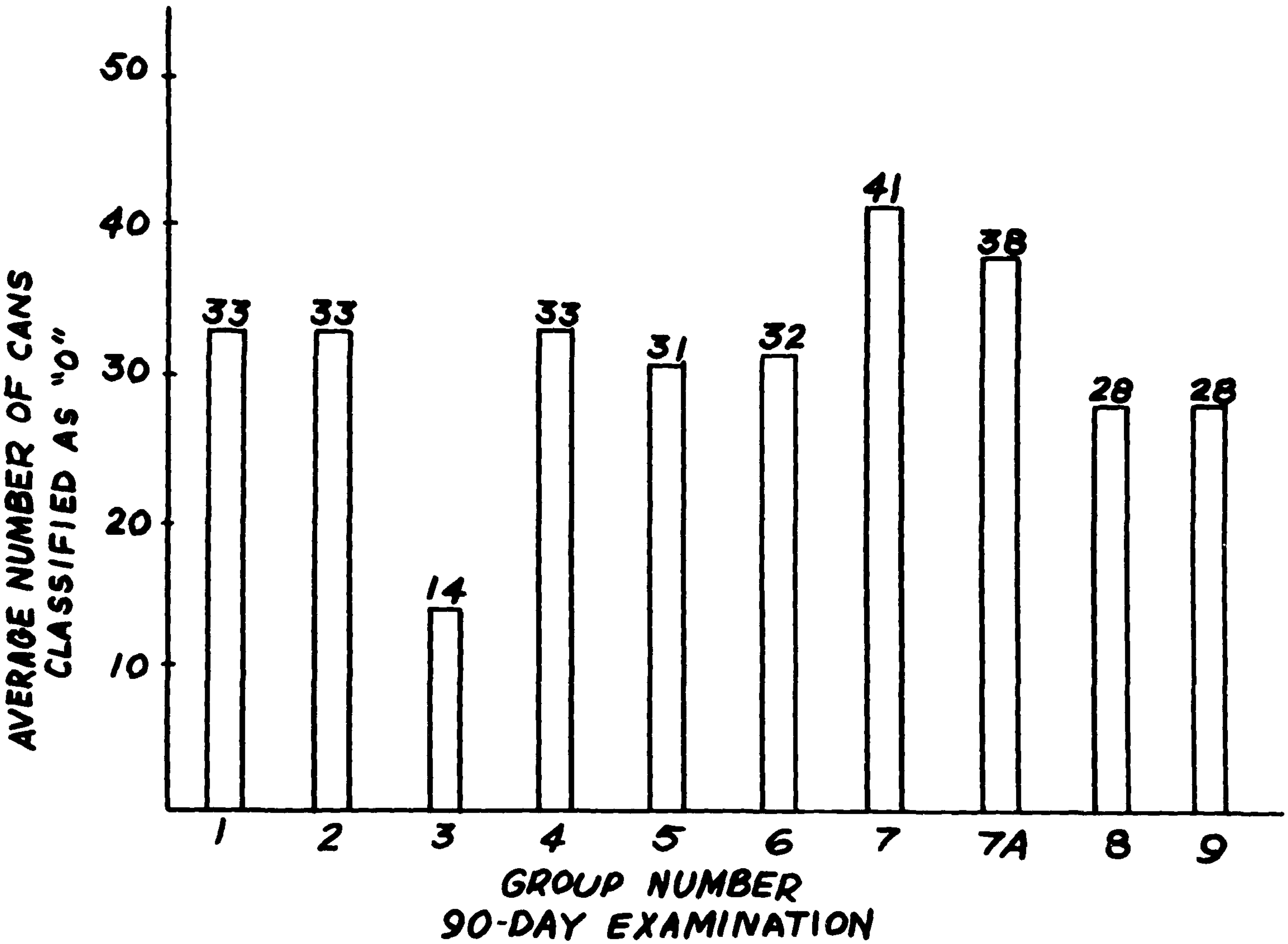


Figure 10. Average number of cans which were classified as "0" at the beginning of test - for the groups examined after 90 days.

APPENDIX B

APPENDIX B

Table I through Table IV	Monthly temperature changes during the entire exposure test. The tables show the daily high/low temperatures for each month of the test.
Table V through Table VII	Average results of the condition of the cans in all layers of the load for each examination. The tables show the average number of cans classified from "2" to "4" in the top layers of each group, and the cans classified from "0" to "2" in all remaining layers.

TABLE I

Temperatures at Oakland for the Months of August and September 1969

August	High	Low	September	High	Low
1	68°F.	53°F.	1	76°F.	53°F.
2	75	54	2	72	56
3	77	55	3	72	53
4	75	58	4	66	54
5	77	57	5	68	56
6	70	52	6	77	56
7	72	54	7	84	64
8	71	54	8	79	59
9	69	55	9	69	56
10	71	56	10	74	57
11	69	55	11	66	56
12	80	55	12	65	56
13	83	54	13	69	58
14	67	51	14	67	53
15	68	53	15	66	56
16	72	53	16	64	55
17	68	54	17	69	58
18	65	55	18	72	59
19	66	57	19	66	58
20	77	53	20	69	60
21	78	57	21	71	57
22	69	55	22	72	53
23	66	56	23	71	54
24	68	57	24	72	58
25	77	54	25	81	56
26	68	56	26	69	58
27	74	56	27	68	58
28	68	54	28	75	58
29	74	54	29	72	58
30	74	54	30	71	56
31	77	55			
AVERAGE	72°F.	54.7°F.	AVERAGE	70.7°F.	56.7°F.

TABLE II

Temperatures at Oakland for the Months of October and November 1969

October	High	Low	November	High	Low
1	71°F.	57°F.	1	72°F.	49°F.
2	71	56	2	68	49
3	71	58	3	63	52
4	77	58	4	63	52
5	77	60	5	62	53
6	76	51	6	61	52
7	78	51	7	60	51
8	75	57	8	67	56
9	67	57	9	65	47
10	69	57	10	66	48
11	69	61	11	70	49
12	77	60	12	65	48
13	71	50	13	67	48
14	65	57	14	63	52
15	65	55	15	61	54
16	63	56	16	60	48
17	66	58	17	64	42
18	63	55	18	63	42
19	65	51	19	60	46
20	70	47	20	61	45
21	70	51	21	59	42
22	68	53	22	62	46
23	62	58	23	65	41
24	60	58	24	61	46
25	62	58	25	62	43
26	63	51	26	62	44
27	60	57	27	62	41
28	62	50	28	63	42
29	65	51	29	61	40
30	65	50	30	58	40
31	78	51			
AVERAGE	70.6°F.	54.8°F.	AVERAGE	63.2°F.	46.9°F.
			TOTAL PRECIPITATION .71 inches		

TABLE III

Temperatures at Oakland for the Months of

December 1969 and January 1970

December	High	Low	January	High	Low
1	59°F.	38°F.	1	60°F.	35°F.
2	60	38	2	52	39
3	59	41	3	52	35
4	58	45	4	53	36
5	58	42	5	52	35
6	58	42	6	50	38
7	58	48	7	52	43
8	59	48	8	56	49
9	57	47	9	54	50
10	58	50	10	57	50
11	59	54	11	57	50
12	59	57	12	58	52
13	60	51	13	59	54
14	61	51	14	58	53
15	60	50	15	56	51
16	62	46	16	61	56
17	61	51	17	59	54
18	60	52	18	58	53
19	61	58	19	60	53
20	64	59	20	60	53
21	63	48	21	61	58
22	55	45	22	62	58
23	59	50	23	62	55
24	58	56	24	58	50
25	59	47	25	59	45
26	57	43	26	60	48
27	57	44	27	58	47
28	60	38	28	57	39
29	54	43	29	57	41
30	54	40	30	57	46
31	54	39	31	55	43
AVERAGE	58.7°F.	47.3°F.	AVERAGE	57.1°F.	47.4°F.
TOTAL PRECIPITATION 4.33 inches			TOTAL PRECIPITATION 2.53 inches		

TABLE IV

Temperatures at Oakland for the Month of February 1970

February	High	Low
1	59°F.	48°F.
2	64	44
3	57	44
4	60	48
5	57	50
6	60	51
7	66	51
8	70	50
9	63	50
10	65	50
11	63	54
12	59	45
13	58	52
14	58	50
15	59	47
16	61	50
17	57	47
18	63	43
19	64	46
20	67	45
21	62	43
22	60	43
23	61	44
24	67	50
25	66	45
26	66	45
27	63	45
28	62	55
AVERAGE	62°F.	48.1°F.
TOTAL PRECIPITATION		1.69 inches

TABLE V

AVERAGE OF RESULTS OF CAN CORROSION AFTER 30 DAYS OUTDOOR STORAGE

Can Classification	Top Layer			2nd Layer			3rd Layer			4th Layer			5th Layer			6th Layer		
	2	3	4*	0	1	2	0	1	2	0	1	2	0	1	2	0	1	2
Load 1	15	8	0	27	20	0	34	14	0	37	10	4	44	4	0	41	7	0
Load 2	27	6	0	33	0	15	31	11	16	26	11	11	27	12	7	36	5	4
Load 3	16	8	1	37	5	6	38	4	6	38	2	21	41	0	4	29	1	18
Load 4	15	3	-	32	10	6	32	11	5	33	9	2	40	2	2	42	6	0
Load 5	11	1	-	8	30	8	21	21	6	22	19	7	38	10	0	-	-	-
Load 6	24	16	-	1	16	30	0	6	41	0	5	42	0	5	42	-	-	-
Load 7	16	3	-	18	2	24	16	5	23	16	20	12	18	13	16	18	13	16
Load 7A	10	-	-	26	16	1	32	5	10	28	2	13	31	3	13	39	13	0
Load 8	9	1	-	37	7	3	29	15	3	21	7	10	29	6	8	33	8	2
Load 9	22	10	-	14	11	22	18	10	23	13	11	23	10	12	21	10	19	19

*NOTE: This column shows the classification of cans in all layers with the top layer only containing cans which contained corrosion classified 2 to 4. As described previously, the cans classified in "3" in this layer were used to establish the load performance.

TABLE VI

AVERAGE OF RESULTS OF CAN CORROSION AFTER ( ) DAYS OUTDOOR STORAGE

Can Classification	Top Layer			2nd Layer			3rd Layer			4th Layer			5th Layer			6th Layer		
	2	3	4*	0	1	2	0	1	2	0	1	2	0	1	2	0	1	2
Load 1	13	10	-	35	3	5	38	7	7	36	5	6	37	10	5	43	5	0
Load 2	25	4	-	30	9	9	30	9	8	32	8	9	33	9	7	32	9	7
Load 3	14	9	-	42	6	0	41	7	0	37	7	0	43	7	0	43	6	0
Load 4	20	25	2	19	16	13	24	13	15	26	9	9	24	10	15	26	10	12
Load 5	5	0	0	39	5	5	41	4	3	42	4	2	44	3	1	-	-	-
Load 6	31	13	1	8	3	33	7	11	30	3	8	37	5	10	33	-	-	-
Load 7	14	5	-	17	11	19	31	12	7	25	10	13	26	11	11	25	14	8
Load 7A	4	0	0	17	29	2	23	23	2	26	20	2	26	20	2	32	15	1
Load 8	9	0	0	38	3	7	38	6	5	29	10	9	28	11	9	13	10	5
Load 9	There were no changes in loads repacked after 30 days. The cans and cases of all loads examined were dry.																	

*NOTE: This column shows the classification of cans in all layers with the top layer only containing cans which contained corrosion classified 2 to 4. As described previously, the cans classified in "3" in this layer were used to establish the load performance.

TABLE VII

AVERAGE OF RESULTS OF CAN CORROSION AFTER 90 DAYS OUTDOOR STORAGE

Can Classification	Top Layer			2nd Layer			3rd Layer			4th Layer			5th Layer			6th Layer		
	2	3	4*	0	1	2	0	1	2	0	1	2	0	1	2	0	1	2
Load 1	19	12	-	28	8	12	27	7	14	37	5	7	38	5	5	33	9	6
Load 2	20	8	-	38	7	4	39	3	2	41	4	3	38	3	7	39	5	8
Load 3	33	7	-	10	4	1	10	4	33	9	18	21	11	9	25	12	9	27
Load 4	23	19	-	23	6	19	26	5	14	37	5	6	38	4	5	42	3	3
Load 5	7	2	-	22	27	-	22	15	11	24	11	10	22	22	4			
Load 6	20	9	1	20	6	23	21	9	18	20	11	15	24	13	11	26	19	9
Load 7	13	-	-	34	4	10	39	4	5	36	7	5	39	5	4	38	5	5
Load 7A	2	-	-	37	6	5	40	4	4	39	6	3	38	3	7	38	6	4
Load 8	8	-	-	[illegible]6	7	15	28	14	5	18	16	14	21	11	15	21	17	10
Load 9	18	20	-	23	7	18	25	7	16	25	8	15	37	5	6	31	8	9

*NOTE: This column shows the classification of cans in all layers with the top layer only containing cans which contained corrosion classified 2 to 4. As described previously, the cans classified in "3" in this layer were used to establish the load performance.

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13. ABSTRACT

Can corrosion problems were being reported by the Defense Supply Agency on standard sheathed, shrouded, and palletized loads of nonperishable subsistence which could not be alleviated by field expedients applied to the loads.

To obtain data on a controlled basis, a test program was initiated to expose to condensation 90 unit loads, consisting of ten groups of nine loads each. The site chosen was the Naval Supply Center at Oakland, California, and tests were initiated with the cooperation of their Veterinary Detachment, Headquarters of the Defense Supply Agency, and Defense Personnel Support Center under the monitorship of U. S. Army Natick Laboratories. Tests included variables in exposure time sheathing, internal polyethylene shroud, taping, ventilation, and configuration of the assembled load.

DD FORM 1 NOV 65 1473 REPLACES DD FORM 1473, 1 JAN 64, WHICH IS OBSOLETE FOR ARMY USE.

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14. KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
Storage	8, 6					
Cans	1, 7					
Metals	1, 7					
Food	1, 7					
Corrosion	8, 7					
Exposure	6					
Sheathing	6					
Coverings	6					
Polyethylene	6					
Taping	6					
Ventilation	6					
Load Configuration	6					
Military Requirements	4					